

Groundwater

The City utilizes groundwater from five wells as a source for its water supply. Liquid chlorine (sodium hypochlorite) is added to the pumped groundwater at the well site for preventative disinfection. All five well sites have 10,000-gallon pressure tanks. Currently two of the wells are off-line for rehabilitation.

Surface Water

Untreated Surface Water

Lincoln is located in the PCWA Zone 1 service area. The sources of surface water supply entitlements available to PCWA for use in Zone 1 include: (1) a surface water supply contract with PG&E for 100,400 acre-feet per year of Yuba Bear water that is delivered through their Drum Spaulding hydro system; (2) surface water associated with the PCWA's Middle Fork Project water rights which total 120,000 acre-feet per year; and (3) a Central Valley Project contract with the United States Bureau of Reclamation for a minimum of 35,000 acre-feet per year of municipal and industrial use water. This raw surface water is delivered to PCWA's Sunset and Foothill Treatment Plants for use in Zone 1. PCWA also delivers untreated surface water via PCWA's Caperton Canal system to raw water customers within the City of Lincoln. Raw surface water is transported to the PCWA Sunset and Foothill Treatment Plants.

The Nevada Irrigation District (NID) delivers untreated surface water via NID's Hemphill Canal to raw water customers within the City of Lincoln.

Treated Surface Water

The City of Lincoln purchases treated surface water from the Sunset and Foothill Treatment Plants through long-term contracts with the PCWA and distributes the water to Lincoln businesses and residents through the City's distribution system.

Recycled Water

Wastewater effluent from the Lincoln Wastewater Treatment and Reclamation Facility (WWTRF) is utilized for irrigation at four sites with a net area of 382 acres (Eco:Logic, 2002). These are as follows:

1. 122 acres near the City airport
2. 38 acres at the WWTP site

3. 105 acres at Antonio Mountain Ranch, south of the WWTRF
4. 117 acres at the Warm Springs site, west of the WWTRF

Plans to increase the use of recycled water are being developed (Eco:Logic, 2002). A copy of the draft Wastewater Reclamation Study prepared by Eco:Logic is included in Appendix C.

Transfer or Exchange Opportunities

PCWA has limited operational flexibility to redirect raw surface water flows from various sources to its treatment plants to meet Zone 1 urban treated water demand during varying dry year scenarios. A description of PCWA's water supplies, excerpted from the PCWA Urban Management Plan Update of 2000, is included in Appendix D. PCWA has sufficient surface water entitlements to meet the current (as of early 2001) General Plans within PCWA Zone 1, including Lincoln's estimated buildout water demands of 35,000 acre-feet per year.

Future Projects to Meet Projected Demand

The City has plans for several water supply projects and programs to meet total projected water demand and increase reliability of water supplies. These include additional groundwater wells, an expanded conjunctive use program, increased use of reclaimed water and implementation of additional Demand Management Measures. More detail is provided below.

Groundwater Wells

The City has plans to increase the number of municipal water supply wells in order to supplement surface water supplies, increase water supply reliability, provide emergency supplies and help meet peak demand. The goal is to be able to meet 20 million gallons per day (MGD) demand with groundwater on a short-term basis. Studies by Spectrum-Gasch (1999) and Boyle Engineering (1990) show that there are groundwater resources available in the Lincoln area. The City is currently completing additional groundwater investigations. The results of these investigations will be analyzed and used to help determine optimal well spacing and pumping schedules. The City estimates additional wells will be built. Geologic logging, downhole geophysical logging and aquifer stress tests have been conducted

on new monitoring wells as part of a cooperative project between the City and the California Department of Water Resources (DWR).

Future Well Locations

The optimum number, locations, spacing, depths, and completion design for planned future City of Lincoln drinking water wells will be determined based on the results of the current groundwater investigations. Based on existing information it is estimated that ten wells will be required to provide the 20 MGD short-term groundwater supply goal. Spectrum-Gasch (1999) estimated that 30% of the area within the Lincoln SOI is underlain by productive aquifers, which are restricted to the western part (west of Highway 65). They identified two areas as having the best potential for high yield wells, primarily based on the inferred thickness of the productive aquifer zone they mapped and existing well information:

1. Lincoln Airport vicinity
2. Vicinity of Orchard Creek and Ingram Slough confluence

These are preliminary potential future well locations that will be refined based on the results of the proposed groundwater investigation.

Projected Groundwater Pumping

The City of Lincoln proposed future increase in groundwater extraction to 20 MGD for short-term periods translates to 61.4 acre-feet per day or, for the unrealistic worst-case scenario of continuous pumping at this rate, 22,400 acre-feet per year.

Sufficiency of Groundwater to Meet Projected Pumping

Existing information indicates that there are significant groundwater resources underlying the Lincoln SOI, especially in the western part of the area. A recent study specifically focused on assessing the groundwater resources across the Lincoln SOI (Spectrum-Gasch, 1999) provided a conservative estimate of 47,250 acre-feet of recoverable water in place, whereas a groundwater modeling study of the larger Northern American River Service Area indicates total groundwater storage of about 287,800 acre-feet (Montgomery Watson, 1995) within the SOI. The same modeling study indicates an average yearly total recharge to the Lincoln SOI area of approximately 17,153 acre-ft./yr., of which 11,664 acre-ft./yr. occurs as deep percolation and 3,697 acre-ft./yr. as inflow from streams or canals. These recharge

estimates likely contain a lot of uncertainty and could be significantly improved with refinement and recalibration of the IGSM model over the Lincoln Area, incorporating recent and future information on the hydrogeology and land usage.

While the initial estimate of groundwater recharge suggests that the worst case scenario pumping would not be fully replenished by recharge, it is probable that the increasing pumping stress on the groundwater system would induce increased recharge – resulting in stabilized, albeit lower, future groundwater levels. The impact of the increased pumping could be much better predicted using the calibrated IGSM, or another, groundwater simulation model.

Implementation Timeline

The location and operation of the City's new wells was determined by studying information gathered during recent groundwater investigations. Construction of additional wells will follow as funding is approved by the City Council.

Expected Increase in Water Supply

Additional groundwater wells will result in an increase in water supplies for the City. The goal is to develop a well field that will be able to meet 20 MGD demand on a short-term basis. Results from the planned groundwater studies will provide an estimate of aquifer yield. Spectrum-Gasch (1999) estimated the aquifer is capable of yielding 20,000 acre-feet per year.

Surface Water and Groundwater Conjunctive Use Program

Conjunctive use is the planned, coordinated use of groundwater and surface water to optimize available water supplies. Surface water is used when it is available and groundwater is used when surface water supplies are reduced or not available. The aquifer is utilized as a storage reservoir recharged from precipitation, subsurface inflow and applied surface water. This stored water is then available when needed.

Program Development

The surface water and groundwater conjunctive use program is being expanded to more fully utilize the groundwater basin within the Lincoln sphere of influence. Surface water will be utilized to meet the majority of the City's water demands and help provide recharge to the aquifer. The well system will help meet peaking demands. The wells, in conjunction with water stored in above ground tanks, will

also be utilized to meet total demand during interruptions in surface water deliveries due to shortages or mechanical failures. The City is planning recharge studies in cooperation with DWR to better characterize recharge to the basin.

Implementation Timeline

A groundwater investigation has been ongoing. Results of the investigation have been utilized to determine the location and operation of the City's new wells. The conjunctive use program will be implemented in phases as the wells are completed. More complete utilization of the groundwater basin will be possible as additional wells are built and operated. Full implementation of the conjunctive use program is expected by 2020.

Expected Increase in Water Supply

Additional groundwater wells will result in an increase in water supplies for the City adequate to meet short-term shortfalls in deliveries from PCWA as large as 20 MGD. Spectrum-Gasch (1999) estimated the aquifer is capable of yielding 20,000 acre-feet per year. Active recharge with surface water or reclaimed water could increase this amount.

Water Reclamation

An administrative draft Wastewater Reclamation Study for the City has been prepared (Eco:Logic, 2001). The study describes a new 3.3 MGD Wastewater Treatment and Reclamation Facility (WWTRF), identifies potential recycled water use areas in the Lincoln area, evaluates the market for recycled water, and identifies potential projects. More detail on the potential use of reclaimed water is included in Chapter 5. A copy of the administrative draft Wastewater Reclamation Study is included as Appendix C.

Implementation Timeline

The Wastewater Treatment and Reclamation Facility began operation in 2004. Effluent from the WWTRF undergoes treatment processes that include oxidation, coagulation, clarification, filtration and disinfection. This level of treatment allows for increased use of reclaimed water.

Expected Increase in Water Supply

It is estimated that the City will generate 13,000 acre-feet per year of wastewater by the year 2020. According to an administrative draft City of Lincoln Wastewater Reclamation Study, there is an estimated 24,700 acre-feet of demand for reclaimed water near Lincoln. With completion of the planned Wastewater Treatment and Reclamation Facility, the reclaimed water is suitable for landscape, crop, and golf course irrigation. Some of the reclaimed water is expected to be used outside the City and therefore will not serve as a direct source of water supply for the City. Irrigation with reclaimed wastewater in-lieu of local groundwater will help recharge aquifers in the area and reduce the dependence on pumped groundwater. The use of reclaimed water may result in an increase in the amount of groundwater available to the City. The amount of increase in groundwater supply to the City will depend on the proximity of the reclaimed water usage to City wells. Reclaimed water use within the City (e.g., landscape and golf course irrigation) will serve as additional water supply. The amount of increase in water supply will depend on the type of use and quantity of reclaimed water used. More information on use of reclaimed water is included in Chapter 5.

Demand Management Measures

Current Demand Management Measures

The City is currently implementing Demand Management Measures (DMMs) in order to more efficiently use water supplies. Details of these efforts are provided in Chapter 8.

Planned Demand Management Measures

DMMs implemented by the City will delay expanding capacity of the City's water system or finding new sources. Chapter 8 describes current and planned DMMs for the City and implementation timelines.

Implementation Timeline

It is estimated that all applicable DMMs will be initiated by the next update to the City's Urban Water Management Plan in 2010.

Expected Increase in Water Supply

Demand Management Measures do not directly increase water supplies. They do, however, serve to delay the need for obtaining additional supplies and expanding the capacity of the water system.

Projects to Meet Dry-Year Demand

The City is currently developing a conjunctive use program that will allow for optimization of the available surface water and groundwater supplies. The wells, in conjunction with water stored in above ground tanks, will also be utilized to meet total demand during interruptions in surface water deliveries due to shortages or mechanical failures. The program is described above. Some of the existing and planned Demand Management Measures (e.g., water surveys, and public education programs) can be expanded as needed during dry years to decrease demand.

The City has developed a Water Shortage Contingency Plan (Chapter 7) consisting of four Stages of Action to address potential water supply reductions of up to 50%. Upon the declaration of a water shortage by the City Council, the appropriate stage can be implemented. The stages include voluntary and mandatory water demand management measures that may be implemented as appropriate to address the severity and anticipated duration of the water supply shortage. Stages of Action may be triggered by, 1) current supply conditions, 2) future supply conditions, or 3) a loss of supply due to natural or human induced disasters.

Developer Agreements

During the course of planning for developments, the City has entered into Development Agreements between land developers and the City pursuant to the issuance of a Development Permit by the City, for the construction and development of projects. These Development Agreements include a number of provisions for the developers to construct, or provide funds for the construction of, water supply related facilities such as:

- Water storage facilities
- Municipal well construction
- Water transmission facilities
- Dedication to the City of water rights to groundwater underlying the project

Historic and Projected Annual Water Demand

Table 5 presents historical and projected potable water demand for the City of Lincoln forecasted to the year 2025. A rapid increase in water use is expected between the years 2002 and 2010 because of high growths in population, housing, and employment.

Table 5: Historic and Projected Potable Water Demand (acre-feet)

Year	1996	1997	1998	1999	2000	2005	2010	2015	2020	2025
Potable Water Demand	2,032	2,390	2,169	2,766	4,099	11,440	16,060	22,080	23,150	23,970

Water use projections found in Table 5 are calculated based on housing and employment projections, commercial and industrial development, and average water use by customer type. Housing and employment projections were taken from the Sacramento Area Council of Governments (SACOG, 2004) in five-year increments from year 2005 to 2025. Land development for commercial and industrial uses was received from the City of Lincoln's Community Development Department. Average annual water usage by various customer types was taken from the Surface Water Supply Update for Western Placer County (PCWA, 2001) for Lower Zone 1 Planning, which includes the City of Lincoln. Buildout demand data provided in General Plan background information from City of Lincoln staff. A detailed description of the data sources and methods used to calculate historical and projected water use is included in the remainder of this section.

Historic Potable Water Demand

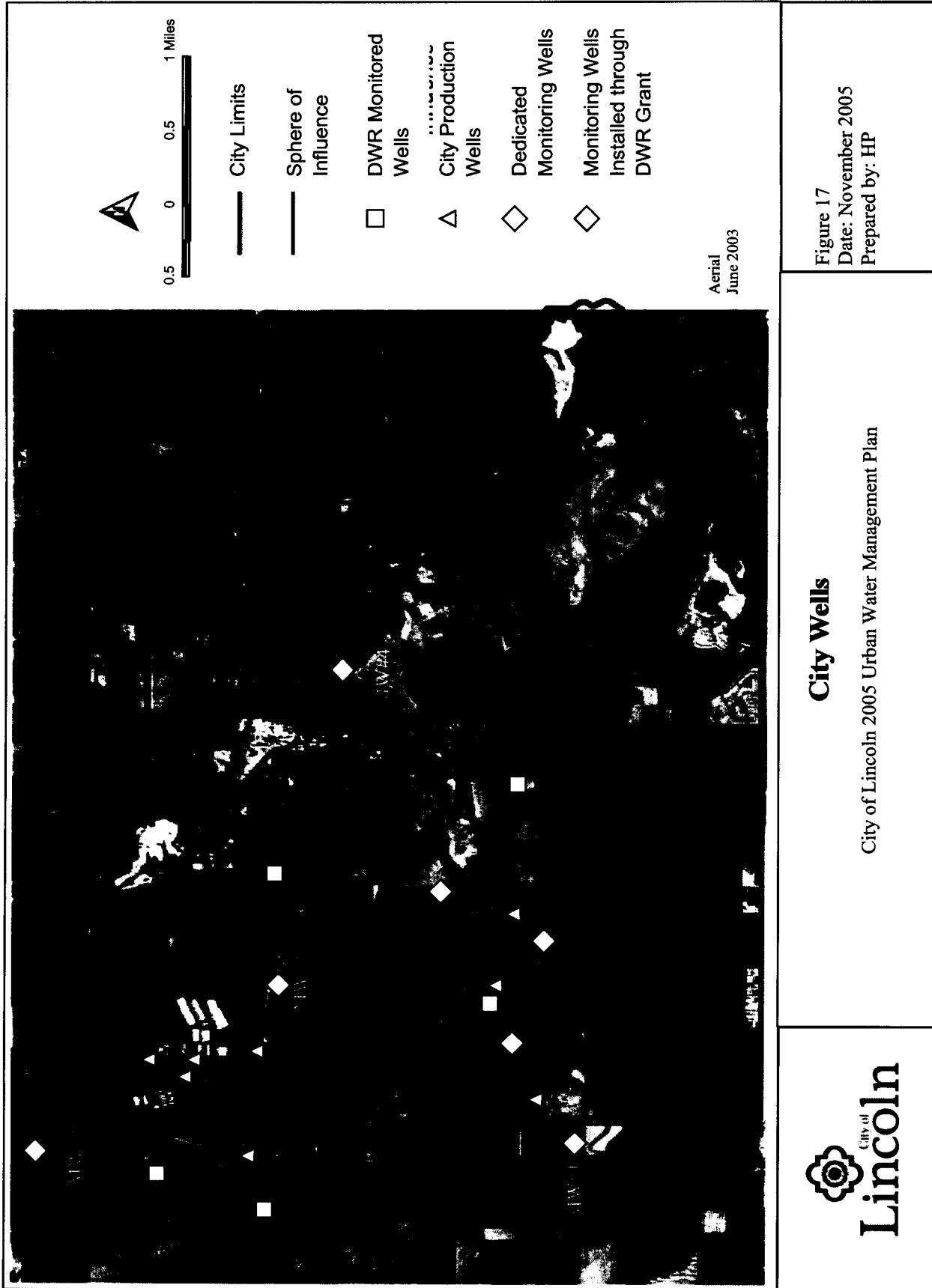
The City of Lincoln receives its water supply from surface water deliveries by PCWA and from groundwater pumped from City owned wells. Table 6 presents the historical potable water demand for the City of Lincoln in acre-feet for the years 1996 through 2000 (Lincoln, 1995-1999). Data on the amount of treated surface water delivered to the City of Lincoln was supplied by PCWA. The City of Lincoln supplied its own data on annual groundwater production.

Table 6: Historic potable water demand (acre-feet)

Year	2000	2001	2002	2003	2004
Groundwater	569	408	713	543	298
Surface Water	3,530	3,326	4,063	4,845	7,241
Total	4,099	3,734	4,776	5,388	7,539

Location

Figure 17 shows locations of City wells.



Projected Residential Water Demand

Residential water demand is estimated based on the projected number of housing units provided from SACOG (2004). The total number of housing units provided by SACOG is divided into three residential categories: low-density units, medium-density units, and high-density units. Table 7 shows the distribution used to calculate the number of housing units within each category. Table 7 is the residential zoning objective taken from the City of Lincoln's General Plan (SACOG, 1988).

Table 7: Distribution of housing units by type

Low-Density Residential	70 Percent
Medium-Density Residential	20 Percent
High-Density Residential	10 Percent

The annual residential water demand is calculated by multiplying the number of housing units for each residential category by the average water use. Table 8 shows the daily average water demand in gallons per day (GPD) by residential category applied in the projections (PCWA 2001).

Table 8: Average water demand by housing type

Housing Unit Type	GPD
Low-Density Residential	806
Medium-Density Residential	536
High-Density Residential	188

Projected Commercial, Industrial, and Other Major Water Demand

An estimate of the total acreage of commercial and industrial land developed as of 2002 was received from the City of Lincoln's Community Development Department. Estimates of future water use were projected from the 2002 data using the annual employment growth rate provided by SACOG (2001). The projected acreage was multiplied by the average daily water demand determined by PCWA (2001) for commercial and industrial landuse. Projections for water demand by public schools

are taken from SACOG (2001). The projected number of schools was multiplied by the average daily water use determined by PCWA (2001).

Table 9 displays the projected water demand by customer type to the year 2025. SACOG (2001) projections assume that the City of Lincoln will not annex any additional land over the next 25 years. The projections predict the annual housing growth rate will level off in 2015 to less than 1% due to buildout of land designated for residential development. Consequently, the total residential water use levels off around the year 2015.

Table 9: Projected water demand by customer type

Customer Type	Projected Water Demand (acre-feet)				
	Year				
	2005	2010	2015	2020	2025
Low-Density Residential	7,180	10,160	13,900	14,360	14,670
Medium-Density Residential	1,360	1,930	2,640	2,730	2,790
High-Density Residential	240	340	460	480	490
Commercial	300	380	550	610	680
Industrial	1,660	2,120	3,050	3,400	3,770
Schools and Public Facilities	700	1,130	1,480	1,570	1,570
Subtotal	11,440	16,060	22,080	23,150	23,970
Raw Water (PCWA)	5,600	5,600	5,600	5,600	5,600
Raw Water (NID)	1,540	1,540	1,540	1,540	1,540
Total	18,580	23,200	29,220	30,290	31,110

Projected Raw Water Demand

PCWA currently supplies private customers within the City of Lincoln with 5,600 acre-feet of raw water per year. This water supply is utilized by agriculture, golf courses, parks, and other users. PCWA (2001) assumes that deliveries of raw water to these private customers will remain at 5,600 acre-feet per year through buildout. This analysis relies upon that assumption.

The Nevada Irrigation District (NID) supplies raw water for landscape irrigation within the City. In 2001, NID delivered 1,540 acre-feet of raw water. NID also supplies raw water for agricultural irrigation within the Lincoln Sphere of Influence.

In the event that future land use changes result in a conversion of agricultural land to urban uses, NID raw water currently used for agricultural irrigation will be available for irrigation of urban landscapes. For our supply and demand analysis, we assume that the net raw water supplied by NID within the Lincoln Sphere of Influence will remain relatively consistent with historic use.

Unaccounted for System Losses

The City has not conducted a leak detection audit or survey and has not developed any leak detection programs. Unaccounted water losses are estimated to be no more than 10% of total water into the City's system.

Historic Number of Service Connections

The number of past and current water service connections for different water use sectors, and projected number of connections are given in Table 10 (SACOG 2004).

Table 10: Service Connections

Customer Type	Year					
	2000	2005	2010	2015	2020	2025
General & Residential	4,856	11,600	14,434	20,463	21,294	22,159
Commercial	169	300	359	516	576	643
Industrial	10	17	21	31	34	37
Total	5,035	11,917	14,814	21,010	21,904	22,839

Reliability Comparison

Table 11 presents surface water supply and demand comparisons for PCWA Zones 1 and 5 for an average water year in the year 2020, a single dry year and multiple dry years based on information in the PCWA Urban Water Management Plan Update of 2000. PCWA combines water supply data from Zone 1 and Zone 5. Lincoln is served in Zone 1. In the year 2020, a surface water deficit is projected for year two and three of a multiple dry year worst case scenario for PCWA Zones 1 and 5.

**Table 11: Supply and Demand Comparison for PCWA
Zones 1 and 5 Surface Water**

	Average	Single Dry	Multiple Dry Years		
	Water Year	Water Year	Year 1	Year 2	Year 3
Water Supply ac-ft/yr	265,400	221,550	221,550	208,010	187,700
Water Demand ac-ft/yr	246,500	217,500	217,500	217,500	217,500
Surplus of (Deficit) ac-ft/yr	18,900	4,050	4,050	(9,490)	(29,800)

For years in which there is a deficit, PCWA will implement its Water Shortage Contingency Plan contained in their Urban Water Management Plan. A more detailed description of PCWA water supplies and dry year forecasts is included in Appendix D.

The City has plans to increase the number of municipal water supply wells. The goal is to be able to meet 75% of average demand with groundwater on a short-term basis and 20% of the average demand on a long-term basis. Table 12 presents supply and demand comparison for an average water year in the year 2025, a single dry year and multiple dry years based on information in the PCWA Urban Water Management Plan Update of 2000 and projected groundwater produced by City wells. Data from the PCWA 2005 update was unavailable in time for adoption of Lincoln's plan by the December 30, 2005 deadline. The 16,800 acre-feet per year of groundwater in Table 12 represents 75% of the projected total demand at the year 2025. The 4,700 acre-feet per year of groundwater in Table 12 represents 20% of the projected total demand at the year 2025.

**Table 12: Supply and Demand Comparison for PCWA Zones 1 and 5 Surface
Water and Local Groundwater**

	Average	Single Dry	Multiple Dry Years		
Supplies in acre-feet/yr	Water Year	Water Year	Year 1	Year 2	Year 3
PCWA Surface Water Supply	265,400	221,550	221,550	208,010	187,700
Lincoln Groundwater Supply	4,700	16,800	16,800	16,800	16,800
Total supply	270,100	238,350	238,350	224,810	204,500
Water Demand	246,500	217,500	217,500	217,500	217,500
Surplus or (Deficit)	23,600	20,850	20,850	7,310	(13,000)

Inconsistent Water Sources

Both surface water and groundwater sources for Lincoln are relatively reliable. PCWA utilizes several surface water sources and reservoirs and consequently has been able to meet raw and treated surface water demands to date in Zone 1. In the future as the build out of the General Plans in Zone 1 approaches, the Agency forecasts that its surface water supplies may be reduced during multiple year droughts to a point that Zone 1 water demands could not be met. When surface water supplies are limited or not available, Lincoln relies on groundwater and water in its storage tanks to meet demand. For water sources that may not be available, additional water demand management measures would be implemented as necessary.

Three-Year Minimum Water Supply

Based on local conditions, no deficit is expected for the next three years. Table 13 compares supply and demand estimates for the next three years. Demand numbers were generated using the projected water use estimates presented in Table 5 and calculating a uniform growth rate between the years 2005 and 2010. The City has adequate supplies available to meet the projected demand and no deficit is forecast.

Table 13: Three-year minimum supply (acre-feet)

Year	2005	2006	2007
Supply	11,440	12,355	13,343
Demand	11,440	12,355	13,343

Water Supply Reliability

Groundwater

Groundwater elevations fluctuate seasonally; decreasing due to heavy pumping through the summer irrigation season and increasing during the winter due to rebound from reduced pumping and recharge from surface water and subsurface inflow. This seasonal fluctuation can be seen in the inter-annual variation in groundwater elevations in Figure 18, hydrograph for well 12N05E01R01M located near the Lincoln airport (data are from DWR Water Level web page).

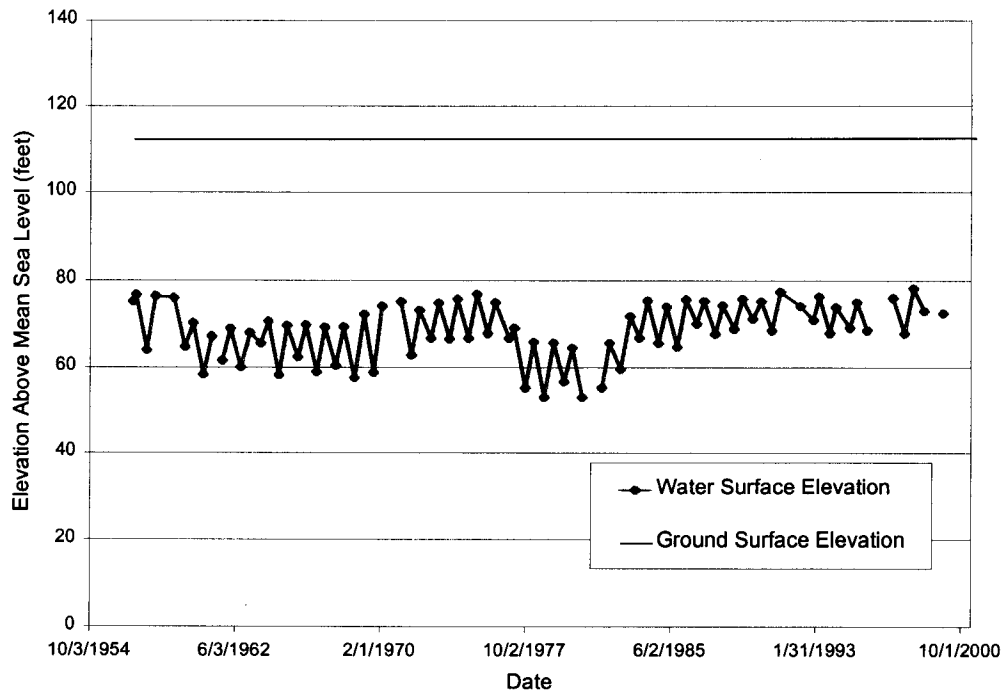


Figure 18: Water Surface Elevation for State Well Number 12N05E01R001M

During dry years, the increased need for irrigation and the decrease in natural recharge may cause groundwater elevations to decline. As shown in Figure 18, the drought in the late 1970's resulted in a temporary lowering of groundwater. Groundwater elevations rebounded after the end of the drought.

Surface Water

The City gets its treated surface water supplies from PCWA. The relatively large volume of PCWA's upstream storage attenuates seasonal fluctuations, allowing deliveries to the City to remain fairly constant. However, according to the PCWA 2000 Urban Water Management Plan Update, surface water supplies could be reduced during multiple dry years. During multiple dry years, in addition to Lincoln's regular Best Management Practices, PCWA would carefully manage its water supply and would consider implementing water shortage response stages as outlined in their Water Shortage Contingency Plan.

Efforts to Avoid Overdraft

Analysis of groundwater level trends in Lincoln area wells monitored by the Department of Water Resources indicates that the basin is not in a state of overdraft. A typical well hydrograph is shown in Figure 18 and in Figures 7 - 16. The conjunctive use program and the Lincoln Groundwater Management Plan are efforts to utilize the groundwater in the City's sphere of influence in a manner that prevents overdraft.

Water Quality

Historical Water Quality

The City of Lincoln has historically supplied water through two sources: groundwater pumped from City wells and surface water delivered by PCWA. A review of historical water quality data from the two sources of supply follows.

Surface Water

Surface water quality data from 1997 to 2001 was reviewed for this analysis. The water quality data were collected by PCWA to satisfy Title 22 requirements for the Foothill water treatment facility, which supplies treated water to the City. The water quality data reviewed included general mineral, physical, and inorganic constituents, as shown in Appendix E.

The data reviewed suggests the treated water supplied by PCWA is of very good quality. No primary or secondary maximum contaminant levels (MCLs), as regulated by the California Department of Health Services, were exceeded. Concentrations for all constituents were relatively stable over time. For example, total alkalinity ranged between 16 and 28 mg/L over the five-year period and total dissolved solids ranged between 34 and 37 mg/L.

Groundwater

Groundwater quality data for City supply wells were reviewed for this analysis. The water quality data reviewed were collected by the City to satisfy Title 22 requirements for four supply wells: Well 2, Well 4, Westwood Well and Moore Road Well. The location of the four wells is shown in Figure 17. The following data were reviewed and summarized as Appendix F.

1. Water samples for Wells 2 and 4 on 4/21/1998, 4/24/2001, and 4/30/2001 for all general mineral, physical, inorganic, regulated chemical organic, and unregulated chemical organics.
2. Water samples for the Westwood Well for the year 2000 and 2001 for all general mineral, physical, inorganic, regulated chemical organic, and unregulated chemical organics.
3. Water samples for the Moore Road Well for the year 2002 for all general mineral, physical, inorganic, regulated chemical organic, and unregulated chemical organics.

The limited groundwater data reviewed suggests that the quality of water underlying the City of Lincoln is good. Regulated and unregulated chemical organics were consistently below detection limits for three wells. The Moore Road Well had one constituent, methylene chloride that was detected but was below the MCL. General mineral, physical, and inorganic parameters varied little between sampling events and well locations. For example, the concentration of total dissolved solids averaged 300 mg/L for each well. Nitrate as (NO₃) ranged between 3 and 15 mg/L and chloride concentrations ranged between 30 and 70 mg/L.

Three water quality constituents exceeded secondary MCLs. The sample that exceeded secondary MCLs was taken from Well # 4 on 4/24/2001. The specific constituents exceeding secondary limits were turbidity, manganese, and iron with concentrations of 5.4 NTU, 0.07 mg/L, and 1.8 mg/L respectively.

The U.S. EPA and California Department of Health Services set Maximum Contaminant Levels (MCLs) for drinking water supplies. No primary MCLs were exceeded. Primary MCLs are based on health effects information generally developed during a risk assessment process.

Projected Water Quality

Surface Water

The City of Lincoln receives its surface water supply from the Placer County Water Agency (PCWA). The water originates in the Yuba and Bear River watersheds as Sierra snow pack. Runoff flows through Lake Spaulding and the PG&E South Canal System to the Foothill and Sunset treatment plants where it is treated before being piped to customers in Lincoln. The surface water supply is relatively pristine and

barring any unforeseen land use changes in the Yuba and Bear River watersheds the quality of water supplied will continue to meet state and federal standards.

Groundwater

The aquifer underlying the City of Lincoln is primarily recharged from major streams including Coon Creek, Auburn Ravine, and Markham Ravine. The generally good water quality of these sources has resulted in groundwater quality suitable for potable use. Assuming the sources of groundwater recharge remain of good quality, current contaminants in groundwater are mitigated and/or do not migrate to municipal wells, and future groundwater contamination is prevented, then groundwater supplies will continue to meet state and federal standards.

Water Quality and Management Strategies

The quality of water dictates numerous management strategies a water purveyor will implement, including, but not limited to, the selection of raw water sources, treatment alternatives, blending options, and modifications to existing treatment facilities. Maintaining and utilizing high quality sources of water simplifies management strategies by increasing water supply alternatives, water supply reliability, and decreasing the cost of treatment. As stated in the previous sections, the City of Lincoln's source water supplies are of good quality. Maintaining high quality source water allows the City to efficiently manage their water resources by minimizing costs while distributing high quality water. The City is currently developing a Groundwater Protection Plan to better protect the quality of its groundwater.

Water Quality and Supply Reliability

The City of Lincoln has two primary sources for water supply: groundwater pumped from City wells and surface water delivered by PCWA. Maintaining the quality of water supplies increases the reliability of each source by ensuring that deliveries are not interrupted due to water quality concerns. A direct result from the degradation of a water supply source is increased treatment cost before consumption. The poorer the quality of the source water, the greater the treatment cost. Groundwater may degrade in quality to the point that is not economically feasible for treatment. In this scenario the degraded source water is taken off-line. This in turn decreases water supply reliability by decreasing the total supply and increasing demands on alternative water supplies.

As stated in the previous sections, the City of Lincoln's source water supplies are of good quality. Currently, water quality does not affect water supply reliability for the City. Maintaining the current level of quality is vital for the City to maintain a reliable water supply.

5

WATER RECYCLING: WASTEWATER SYSTEM

Description

Wastewater from Lincoln is treated at a City-owned Wastewater Treatment and Reclamation Facility (WWTRF) located west-southwest of the downtown area. Operation and maintenance of the WWTRF is the responsibility of an outside contractor. A schematic flow diagram of the WWTRF is shown in Figure 19.

The 3.3 million gallon per day (MGD) WWTRF began operation in 2004 and generated an initial 2.4 MGD of average dry weather flow with expansion capacity to 12 MGD in 2020. The WWTRF replaced the Waste Water Treatment Plant which has been decommissioned. Effluent from the WWTRF undergoes treatment processes that include oxidation, coagulation, clarification, filtration and disinfection.

This level of treatment allows the effluent to meet California Department of Health services (DHS) unrestricted reuse criteria (Eco:Logic, 2001).

A map of Lincoln's wastewater treatment plant locations is shown in Figure 20. Current and projected wastewater generated and treated in Lincoln is presented in Table 14 (Eco:Logic, 2001).



City of Lincoln 2005 Urban Water Management Plan

Figure 19
Date: November 2005
Prepared by: HP

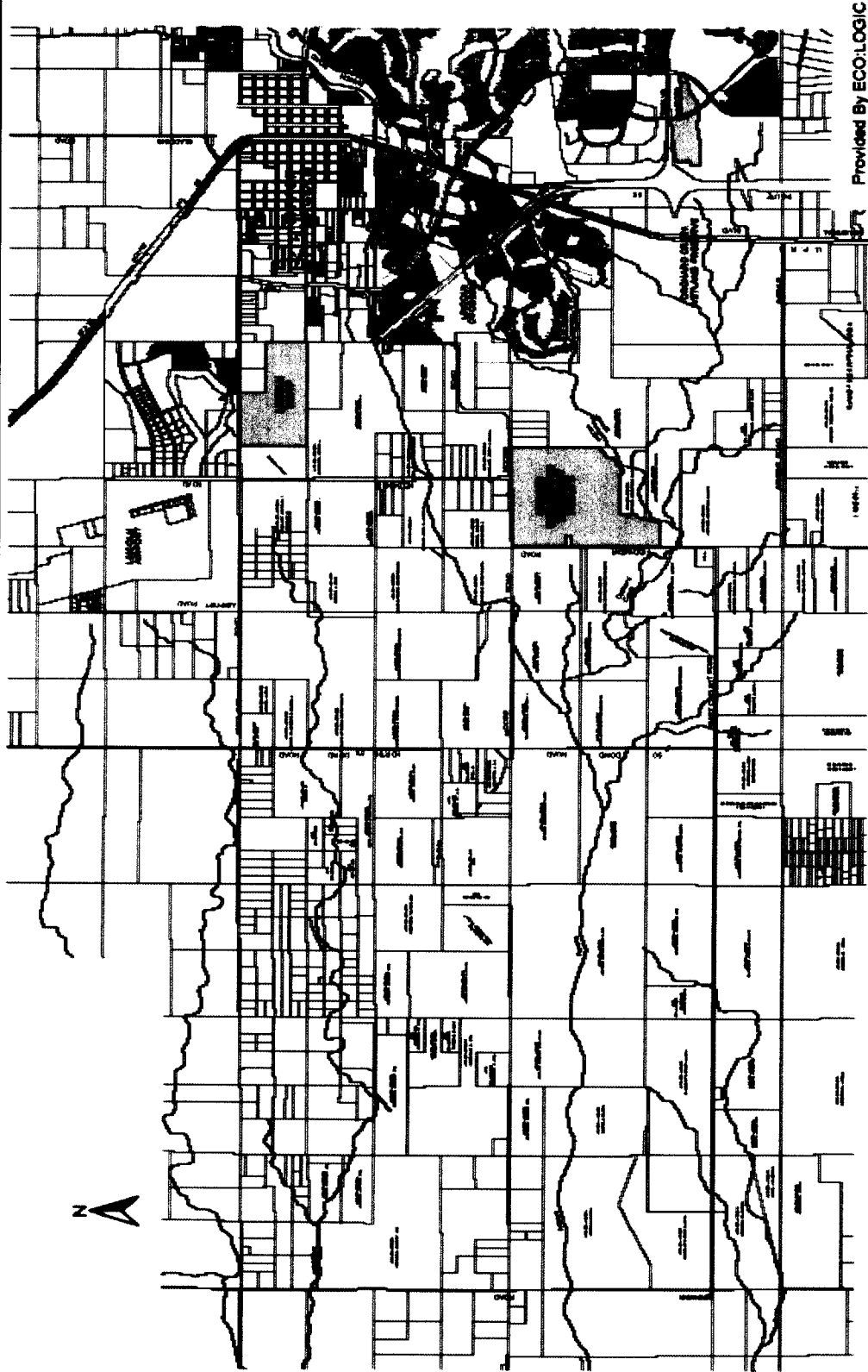


Figure 20
Date: November 2005
Prepared by: HP

Wastewater Treatment Plant Locations

City of Lincoln 2005 Urban Water Management Plan



Table 14: Wastewater Generation and Collection

Year	2005	2010	2015	2020	2025
Wastewater generated in service area (MGD)	2.7	4.2	8.1	12	13
Wastewater collected and treated in service area (MGD)	2.7	4.2	8.1	12	13

Information on volumes of wastewater treated is given in Table 15.

Table 15: Wastewater Treatment Information

Wastewater Treated (Million Gallons/Year)					
Year	2001	2002	2003	2004	2005
Volume	509	576	661	774	880

Wastewater Disposal and Recycled Water Uses

Wastewater effluent from the Lincoln WWTRF is utilized for irrigation on approximately 382 acres at three sites. During the non-irrigation season, effluent is stored for future use. Areas that currently receive recycled water are capable of using 1.8 MGD.

A City of Lincoln Wastewater Reclamation Study was initiated in 2001. The purpose of the study is to determine the potential for reclaiming treated wastewater from the new WWTRF. According to an administrative draft, the objectives of the study are to:

1. Identify potential reclamation areas near the plant.
2. Review water supplies available in the area.
3. Analyze applicable wastewater recycling regulations and summarize their impact on wastewater treatment facilities.
4. Evaluate the market for wastewater reclaiming opportunities.
5. Identify and prioritize the most likely projects for wastewater reclamation.

Potential uses of treated wastewater include:

1. Agricultural irrigation
2. Irrigation of proposed golf course
3. Use by the Western Regional Landfill Authority
4. Industrial
5. Other uses
6. Users outside the study area

With the WWTRF operational, the treated effluent is suitable for the following uses:

1. Irrigation of food crops.
2. Irrigation of parks and playgrounds, with use of appropriate warning signs indicating the water is unsafe for drinking.
3. Irrigation of schoolyards, with use of appropriate warning signs indicating the water is unsafe for drinking.
4. Irrigation of residential landscaping and golf courses, with use of appropriate warning signs indicating the water is unsafe for drinking.
5. Water supply source for recreational impoundments, with use of appropriate perimeter signs.

The projected use of recycled water within the supplier's service area at the end of 5, 10, 15, and 20 years are shown in Table 16 (Eco:Logic, 2001).

Table 16: Projected Use of Recycled Water

Year	2005	2010	2015	2020	2025
MGD	2.7	4.2	8.1	12	13

Table 17, adapted from the City of Lincoln Wastewater Reclamation Study (2001), shows potential uses of reclaimed wastewater.

Table 17: WWTRF Potential Uses of Reclaimed Water

Reclaimed Water User	Peak Water Demand in MGD	Annual Demand in acre-feet ^(a)
Existing		
Agricultural (Non-Rice)	1.8	2,000
Potential		
Agricultural (Non-Rice)	14.3	3,200
Agricultural (Rice)	49.4	18,200
Golf Course	1.2	350
Landfill/MRF	0.11	85
Industrial	1.35	1500
Other	Not significant at this time	Not significant at this time
Total	68.2	25,300

^(a) Annual demand is calculated based on 100-year rainfall.

Encouraging Recycled Water Use

The City of Lincoln Wastewater Reclamation Study (2001) identified potential recycled water use areas in the Lincoln area, evaluated the market for recycled water, and identified potential projects. A copy of the administrative draft Wastewater Reclamation Study is included as Appendix C.

The City continues to encourage the use of recycled water. The Wastewater Reclamation Study reviewed a number of reclamation options and concluded that the preferred reclamation plan would include development of a reclaimed water delivery system and agricultural irrigation using reclaimed water. The study recommends conducting a pilot study of irrigating rice with reclaimed water since the largest potential use of reclaimed water in the Lincoln area is for rice irrigation.

Recycled Water Optimization Plan

The City of Lincoln Wastewater Reclamation Study includes a proposed plan for optimizing the use of reclaimed water through development of a reclaimed water delivery system. One industrial and seven agricultural projects were identified. Specific improvements to the wastewater facilities would be required.

Pipelines (purple) dedicated to serving reclaimed water have been installed in much of the newer development in Lincoln. A reclamation project is currently planned to

convert existing pipelines and construct additional pipelines and connections necessary to supply reclaimed water to the purple pipe and other areas.

The goal of the City reclamation project is to utilize all reclamation water produced by the City Wastewater Treatment and Reclamation Facility (WWTRF).

The City reclamation system will distribute water to both public and private users. The agriculture component will be a significant portion of the reclamation consumption. The City is also working to convert existing industry to utilization of reclamation water from their current potable water demand.

As the City grows the reclamation distribution system will grow. The use of reclamation water will be required for all practical uses in new development. The first phase of the project will provide needed infrastructure for the backbone system and distribution within the existing City and Region.

6

SUPPLY AND DEMAND COMPARISON

The total water supply sources available to the City were compared with the total projected water use over the next 20 years, in five-year increments, for a normal water year, a single dry water year, and multiple dry water years.

“As part of its long-range activities, every urban water supplier should make every effort to ensure the appropriate level of reliability in its water service sufficient to meet the needs of its various categories of customers during normal, dry, and multiple dry years.”
California Water Code

Table 18 describes the available water supply by source for Lincoln over the next 20 years in 5-year increments. Adequate treated surface water from PCWA and groundwater supplies produced from City wells are anticipated to be available during normal years through the year 2025.

Table 18: Projected Supply by Source

Past, Current and Projected Water Supply* - Total (Acre-feet/Yr)					
	2005	2010	2015	2020	2025
Groundwater	4,627	8,685	12,742	16,800	16,800
Surface Water	8,693	13,855	19,018	24,000	28,000
Subtotal	13,320	22,540	31,760	40,800	44,800
Raw Water (PCWA)	5,600	5,600	5,600	5,600	5,600
Raw Water (NID)	1,540	1,540	1,540	1,540	1,540
Subtotal	20,460	29,680	38,900	47,940	51,940

*Recycled water is not included with this analysis. PCWA's UWMP assumes that the Lincoln and Roseville treatment plants will recycle at least 10,000 acre-ft of water by 2010 for the irrigation of rice in areas to the west of Lincoln. The recycled water is not included in the City of Lincoln supply balance but will offset agricultural pumping to the west of Lincoln.

Table 19 presents surface water supply and demand comparisons for PCWA Zones 1 and 5 for an average water year in the year 2025, a single dry year and multiple dry years based on information in the PCWA Urban Water Management Plan Update of 2000. The City has plans to increase the number of municipal water supply wells. The goal is to be able to meet 75% of average demand with groundwater on a short-term basis and 20% of the average demand on a long-term basis. The 16,800 acre-feet per year of groundwater in Table 19 represents 75% of the projected total potable demand in the year 2025. The 4,700 acre-feet per year of groundwater in Table 19 represents 20% of the projected total potable demand in the year 2025. The analysis indicates that PCWA Zone 1 (which includes Lincoln) would be short 29,800 acre-feet in the third year of a drought in the year 2025. When treated surface water deliveries from PCWA to the City of Lincoln are reduced, the City would rely on its well system to meet demand. The shortfall in Zone 1 would be reduced to 13,000 acre-feet by pumping 16,800 acre-feet from Lincoln wells. Any remaining shortage would be met by increasing conservation efforts by the City and PCWA.

**Table 19: Supply and Demand Comparison for PCWA Zones 1 and 5
Surface Water and Local Groundwater**

	Average	Single Dry	Multiple Dry Years		
Supplies in acre-feet/yr	Water Year	Water Year	Year 1	Year 2	Year 3
PCWA Surface Water Supply	65,400	221,550	221,550	208,010	187,700
Lincoln Groundwater Supply	4,700	16,800	16,800	16,800	16,800
Total supply	270,100	238,350	238,350	224,810	204,500
Water Demand	246,500	217,500	217,500	217,500	217,500
Surplus or (Deficit)	23,600	20,850	20,850	7,310	(13,000)

Table 20 presents surface water supply and demand comparisons for the City of Lincoln for an average water year in the year 2025, a single dry year and multiple dry years. The same ratio used by PCWA in Table 19 for decreasing available supplies in single dry year and multiple dry years scenarios was applied to Lincoln's available supply for treated surface water. The ratio of conservation utilized by PCWA was applied to Lincoln's demand for dry year scenarios. Potable surface water supply was interpolated from Table 6-3 of "*Surface Water Supply Update for Western Placer County*" (PCWA, 2001), which predicts a total potable surface water demand of 35,041 acre-feet for Lincoln, which is at buildout conditions. Assuming linear interpolation of existing demand to buildout the potable water available in

2020 is approximately 24,000 acre-feet. Average water demand in the year 2025 is predicted to be 28,750 acre-feet (sum of potable water 23,150 and raw water 5,600). Groundwater supply is assumed to be 20% of the City of Lincoln's demand in 2025 during an average year, and 75% of demand during dry years.

**Table 20: Supply and Demand Comparison for City of Lincoln
Surface Water and Local Groundwater**

Supplies in acre-feet/yr	Average	Single Dry	Multiple Dry Years		
	Water Year	Water Year	Year 1	Year 2	Year 3
Treated Surface Water Supply	24,000	20,040	20,040	18,816	16,968
Lincoln Groundwater Supply	4,700	16,800	16,800	16,800	16,800
Raw Surface Water Supply (PCWA)	5,600	1,000	1,000	0	0
Raw Surface Water Supply (NID)	1,540	300	300	0	0
Total supply	35,840	38,140	38,140	35,616	33,768
Water Demand	28,750	25,300	25,300	25,300	25,300
Surplus or (Deficit)	7,090	12,840	12,840	10,316	8,468

7

WATER SHORTAGE CONTINGENCY PLAN - PREPARATION FOR CATASTROPHIC WATER SUPPLY INTERRUPTION

Catastrophic Interruption of Water Supplies

The City has developed a Draft Water Shortage Resolution to adopt in the event of shortfalls in the water supply system and a Water Shortage Contingency Plan to address supply shortages. In the event of a catastrophic interruption of water supplies, the City would move to Stage 4 of its Water Shortage Contingency Plan. Additional efforts would be coordinated with PCWA, Placer County and the State Office of Emergency Services. The City would also increase its outreach and education efforts through the local media and education programs to focus attention on the water supply situation.

Water Shortage Contingency Resolution

The City has developed a Water Shortage Resolution that describes a mechanism to implement different Stages of Action during water supply shortage situations. Should a water supply shortage arise, the City Council will be able to react quickly to take the appropriate actions.

A copy of the draft Water Shortage Resolution is included in Appendix G.

Stages of Action and Reduction Goals

The City has developed a Water Shortage Contingency Plan consisting of four Stages of Action to address potential water supply reductions of up to 50%. Upon the declaration of a water shortage by the City Council, the appropriate stage can be implemented. The stages, outlined in Table 21, include voluntary and mandatory water demand management measures that may be implemented as appropriate to address the severity and anticipated duration of the water supply shortage. Stages of Action may be triggered by 1) current supply conditions, 2) future supply conditions or a 3) loss of supply due to natural or human induced disasters.

As an example of how the table can be used, if current water supplies were 85 – 90 percent of normal, Stage 1 would be triggered. Stage 1 would also be triggered if future projected water supplies were estimated to be insufficient to provide 80 percent of normal deliveries for the next two years. Loss of water supply due to a natural or human induced disaster would trigger Stage 4.

Table 21: Stages of Action and Water Supply Conditions

Water Shortage Stages and Triggering Mechanisms				
Stage of Action and Percent Reduction of Supply	Stage 1 Water Awareness Up to 15%	Stage 2 Water Alert 15 - 25%	Stage 3 Water Emergency 25 - 35%	Stage 4 Water Crisis 35 - 50%
Water Supply Condition				
Current Supply	Total supply is 85 – 90% of normal	Total supply is 75 – 85% of normal	Total supply is 65 – 75% of normal	Total supply is 65% of normal
Future Supply	Projected supply insufficient to provide 80% of normal deliveries for the next two years	Projected supply insufficient to provide 75% of normal deliveries for the next two years	Projected supply insufficient to provide 65% of normal deliveries for the next two years	Projected supply insufficient to provide 50% of normal deliveries for the next two years
Disaster Loss	Disaster Loss			

Mandatory Prohibitions on Water Waste

The Lincoln City Municipal Code contains provisions that prohibit certain wasteful water use practices including gross waste, allowing leaks from faucets and water closets, watering without a hose nozzle, and irrigating landscapes between the hours of five a.m. and ten p.m. A copy of the relevant section of the Code is included in Appendix H. Due to an error at the time of Code adoption, the hours for watering were inadvertently reversed and the Code section 13.04.430 states “Irrigation of lawns or gardens is restricted to the hours of five a.m. to ten p.m.” The City is in the process of amending this section of the Code to correct this mistake and restrict watering except between the hours of five a.m. to ten a.m. This Urban Water Management Plan includes voluntary and mandatory stages and specific restrictions on water use for each stage.

Penalties

The Lincoln City Municipal Code contains provisions for penalties to water customers that violate regulations and restrictions set forth in the Code. A copy of relevant sections of the Code is included in Appendix I.

Reduction Methods

Stage One (On-going), Water Awareness

All water consumers are encouraged to be aware of water consumption and use water wisely. These measures are expected to result in up to 15 percent reduction in water use. Water consumption should be limited to a reasonable level necessary to maintain the public health, business operations, and landscaping.

Residents and businesses are asked to comply, on a voluntary basis, to limit landscape irrigation to a maximum of three (3) days per week, and adhere to the following landscape watering schedules; odd numbered addresses, limit watering to Tuesday, Thursday and Saturday; even numbered addresses limit watering to Wednesday, Friday and Sunday.

All water consumers are further encouraged to not waste water. The following uses of water constitute waste:

- a. The watering of landscapes in a manner or to an extent, which allows substantial amounts of water to run off the area being watered.
- b. The escape of water through breaks or leaks within the users system for any substantial period of time (12 hours after detection).

Stage Two, Water Alert

Each of the stage one water use regulations shall remain in full force and effect and be mandatory except as modified by this section. All water consumers shall comply with the following conservation measures to achieve a 15 to 25 percent reduction in normal water use:

- a. To help reduce evaporation and maintain healthy plants, water only between the hours of 5 a.m. and 10 a.m.
- b. Equip all hoses or filling apparatus for non-irrigation purposes with an automatic shutoff nozzle.
- c. Limit hosing of landscape surfaces except for health and safety purposes.
- d. Serve water only upon request to restaurant customers.

Stage Three, Water Emergency

Water consumers shall comply with the following conservation measures to achieve a 25 to 35 percent reduction in normal water use. Each of the stage one and two water use regulations shall remain in full force and effect and be mandatory except as modified by this section:

- a. Landscape watering shall be allowed on two (2) days per week. The Director of Public Works shall implement this provision through the establishment of an equitable landscape watering schedule to be set forth in the Resolution adopted by the City Council.
- b. The use of running water from a hose, pipe, or faucet for the purpose of cleaning buildings and paved, tile, wood, plastic or other surfaces is prohibited, except in the event the Director of Public Works, or his designee, determines that such use is the only feasible means of correcting a potential threat to health and safety.
- c. All restaurants that provide table service shall post, in a conspicuous place, a Notice of Drought Conditions, approved by the Director of Public Works, and shall not serve water except upon specific request by the customer.

- d. Boats and vehicles shall be washed only at commercial washing facilities equipped with water recycling equipment or by use of a bucket and hose equipped with a self closing valve that requires operating positive pressure to activate the flow of water.
- e. All pools and spas shall be covered when not in use to reduce evaporative losses unless the Director of Public Works grants an exemption.
- f. Operators of hotels, motels, and other commercial establishments offering lodgings shall post in each room and at each site, a Notice of Drought Condition, approved by the Director of Public Works.
- g. The operation of and introduction of water into ornamental fountains is prohibited.
- h. Such other and further regulations as the City Council may determine, after a public hearing.

Stage Four, Water Crisis

Water consumers shall comply with the following conservation measures to achieve a 35 to 50 percent reduction in normal water use. Each of the stage one, two and three water use regulations shall remain in full force and effect and be mandatory except as modified by this section: (a) Irrigation of any yard, or other landscaped area containing lawn or turf grass areas is prohibited, except by hand held bucket. (b) The introduction of water into swimming pools and spas is prohibited except to maintain the structural integrity of such facilities. (c) Such other and further regulations as the City Council may determine after a public hearing.

Revenue and Expenditure Impacts

Reduction in revenues from water sales due to temporary water supply shortages should not have a significant impact on the City's ability to provide services. Some of the revenue loss would be offset by reduced costs to purchase treated water from PCWA.

Measures to Overcome Impacts

Although significant reductions in City revenues are not expected as a result of water supply shortages, rate increases could be used to offset decreased sales revenue if deemed necessary.

Reduction Measuring Mechanism

Treated surface water and groundwater deliveries are metered as the water flows into the City's distribution system. During various stages of alert, the frequency of measurement can be increased to better characterize demand and compare to reduction goals. This will allow the City to implement additional demand management measures if goals are not being met or relax some restrictions if demand goals are being exceeded.

8

WATER CONSERVATION AND DEMAND MANAGEMENT MEASURES

Fourteen water Demand Management Measures (DMMs) are identified in Table 22. These measures represent the Best Management Practices (BMPs) required by the California Department of Water Resources to be addressed in Urban Water Management Plans. The DMMs are intended to reduce current and future water demands by using water more efficiently. Additional programs may be necessary during periodic water supply shortages. The steps necessary to implement each of

The City of Lincoln is committed to water conservation by implementing water Demand Management Measures (DMMs) that meet city goals in a cost-effective and reliable manner.

the DMMs, methods to evaluate effectiveness and estimated water savings associated with the DMMs are taken from the “Memorandum of Understanding Regarding Urban Water Conservation in California” produced by the California Urban Water Conservation Council (CUWCC, 2002).

Table 22: Demand Management Measures

DMM	DMM Description
1	Water survey programs for single-family and multi-family customers
2	Residential plumbing retrofit
3	System water audits, leak detection, and repair
4	Metering and commodity rates for new connections and retrofit of existing connections
5	Large landscape conservation programs and incentives
6	High-efficiency washing machine rebate programs
7	Public information programs
8	School education programs
9	Conservation programs for commercial, industrial, and institutional accounts
10	Wholesale agency programs
11	Conservation pricing
12	Water conservation coordinator
13	Water waste prohibition
14	Residential ultra-low-flush toilet replacement programs

The City is currently implementing 9 of the 14 DMMs and one DMM (wholesale agency programs) does not apply. The City is currently analyzing the remaining DMMs, developing plans, budgets and timelines for program development and implementation.

Implementation status for the 14 DMMs is shown in Table 23.

Table 23: Implementation Status of DMMs

DMM Implemented		Scheduled	DMM
1		X	Water survey programs for single-family residential and multifamily residential customers
2		X	Residential plumbing retrofit
3	X		System water audits, leak detection, and repair
4	X		Metering with commodity rates for all new connections and retrofit of existing connections
5	X		Large landscape conservation programs and incentives
6		X	High-efficiency washing machine rebate programs
7	X		Public information programs
8	X		School education programs
9	X		Conservation programs for commercial, industrial, and institutional accounts
10	NA		Wholesale agency programs
11	X		Conservation pricing
12	X		Water conservation coordinator
13	X		Water waste prohibition
14		X	Residential ultra-low-flush toilet replacement programs

NA =Not Applicable

Listed below are the 14 DMMs, steps necessary to implement the DMMs, implementation status, implementation schedule, methods to evaluate effectiveness, an estimate of water savings, and an estimated budget. For budget estimating purposes, staff time is calculated at \$100 per hour. These budgets are presented for planning purposes and as estimates of costs for the first steps toward implementation of the DMMs. Tasks to implement the DMMs and associated costs can be refined as programs are prioritized and developed.

Each DMM that is not currently being implemented is scheduled for program development and implementation, as the approved budget allows.

DMM 1. Water survey programs for single-family residential and multifamily residential customers

Steps Necessary to Implement the Demand Management Measure

- a. Develop and implement a strategy targeting and marketing water use surveys to single-family residential and multi-family residential customers.
- b. Directly contact via letter or telephone not less than 20% of single-family residential customers and 20% of multi-family residential customers on a recurring basis.
- c. Surveys shall include indoor and outdoor components, and at a minimum shall have the following elements:

Indoor

- Check for leaks, including toilets and faucets.
- Check showerhead flow rates, aerator flow rates, and offer to replace or recommend replacement, as necessary.
- Check toilet flow rates and offer to install or recommend installation of displacement device or direct customer to ultra low flow toilet (ULFT) replacement program, as necessary; replace leaking toilet flapper, as necessary.

Outdoor

- Check irrigation system and timers.
- Review or develop customer irrigation schedule.
- Check water meter.

Implementation Status

This DMM is not currently being implemented.

Implementation Schedule

The City is planning to develop and implement a strategy targeting and marketing water use surveys to single-family residential and multi-family residential customers by the next update to the City's Urban Water Management Plan.

Methods To Evaluate Effectiveness

Program effectiveness will be measured in terms of meeting the program's implementation objectives. Information needed to evaluate the effectiveness of the DMM includes:

- Number of single-family residential accounts in service area
- Number of multi-family residential accounts in service area
- Number of single-family residential surveys offered during reporting period
- Number of single-family residential surveys completed during reporting period
- Number of multi-family residential surveys offered during reporting period
- Number of multi-family residential surveys completed during reporting period

Conservation Savings

Water savings vary depending on the water fixture and the type of repair/retrofit. Estimates of anticipated water savings are given in Table 24 (CUWCC, 2002).

Table 24: Conservation Savings for DMM 1

Device	Pre-1980 Construction	Post-1980 Construction
Low-flow showerhead retrofit	7.2 gcd*	2.9 gcd
Toilet retrofit (five year life)	1.3 gcd	0.0 gcd
Leak repair	0.5 gcd	0.0 gcd
Landscape survey	10%	10%

*gcd = gallons per capita per day

Budget

An annual budget would include training and staff time, brochures, and purchase of showerheads, aerators, dye tablets, or water conservation kits and other auditing materials.

An estimated budget to begin implementation of DMM 1 is presented in Table 25.

Table 25: Budget for DMM 1

Task	Unit Cost	Number of Units	Subtotal
Staff training and coordination	\$100/hr	40	\$4,000
Develop targeting & marketing strategy	\$100/hr	24	\$2,400
Contact via mail 20% of residential customers	\$0.75	2,500	\$1,875
Conduct surveys of residential customers	\$100/hr	200	\$20,000
Purchase irrigation rain sensors	12	250	\$3,000
Purchase water conservation device kits	\$10	500	\$5,000
Develop materials	\$100/hr	24	\$2,400
Produce mailing materials	\$1	2,500	\$2,500
Total			\$41,175

DMM 2. Residential plumbing retrofit

Steps necessary to implement the Demand Management Measure

- a. Identify single-family and multi-family residences constructed prior to 1992. Develop a targeting and marketing strategy to distribute or directly install high quality, low-flow showerheads (rated 2.5 gpm or less), toilet displacement devices (as needed), toilet flappers (as needed) and faucet aerators (rated 2.2 gpm or less) as practical to residences requiring them.
- b. Maintain distribution and/or direct installation programs so that devices are distributed to not less than 10% of single-family connections and multi-family units on a recurring basis, or require through enforceable ordinance the replacement of high-flow showerheads and other water using fixtures with their low-flow counterparts, until it can be demonstrated that 75% of single-family residences and 75% of multi-family units are fitted with high-quality, low-flow showerheads.
- c. Track the type and number of retrofits completed, devices distributed, and program costs.

Implementation Status

Plumbing fixture standards are being enforced. A retrofit program is not currently being implemented.

Implementation Schedule

The City is planning to develop and implement a strategy targeting the distribution and/or installation of high-quality, low-flow plumbing devices to single-family residential and multi-family residential customers. The City is currently analyzing this DMM, developing a plan, budget and timeline for program implementation by the next update to the UWMP.

Methods To Evaluate Effectiveness

Plumbing device distribution and installation programs are to be maintained at a level sufficient to distribute high-quality, low-flow showerheads to not less than 10% of single-family residences and 10% of multi-family units constructed prior to 1992 by the next UWMP update scheduled for 2010; or the enactment of an enforceable ordinance requiring the replacement of high-flow showerheads and other water use fixtures with their low-flow counterparts. Estimated conservation savings are presented in Table 26.

The information needed to evaluate the effectiveness of the DMM includes:

- a. The target population of pre-1992 single-family residences and multi-family units to be provided showerheads and other water saving devices.
- b. The number of showerhead retrofit kits distributed during previous reporting period.
- c. The number of device retrofits completed during the previous reporting period.
- d. The estimated percentage of pre-1992 single-family residences and multi-family units in service area fitted with low-flow showerheads.

Table 26: Conservation Savings for DMM 2

Device	Pre-1980 Construction	Post-1980 Construction
Low-flow showerhead retrofit	7.2 gcd*	2.9 gcd
Toilet retrofit	1.3 gcd	0.0 gcd

*gcd = gallons per capita per day